LAT Performance Specification Verification Test Plan

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LAT mechanical and electrical performance requirements are shown, along with the requirement parameter and verification test method, and details of the test.

Req #	***Req Title***	***Parameter***	***Ver. Method***	***Verification Test***	***Time of Test***
5.3.2	Instrument Life	>5 years	A	Reliability analysis by System Engineering	Before CDR.
5.3.3	Science Data Interface	Optical serial interface (HSFSB) compliant with IEEE 1393 standard.	T and D	Interface test using SC simulator from SC contractor. This is part of end-to-end performance test	Before LAT env test
5.3.4	Data Services	LAT-SC communication CTDB defined by SAE AS-1773	T and D	Interface test using SC simulator from SC contractor. This is part of end-to-end performance test	Before LAT env test
5.3.5	Operating Modes	Accommodate mission operating mode: Sky Survey	D	"Qual Grid" thermal-balance test Cal. Unit Beam test to verify data taking and rate	During LAT integration
5.3.5	Operating Modes	Accommodate mission operating mode: Pointed Observation	D	"Qual Grid" thermal-balance test Cal. Unit Beam test to verify data taking and rate	During LAT integration
5.3.5	Operating Modes	Accommodate mission operating mode: Safe Mode	D	"Qual Grid" thermal-balance test Flight LAT thermal-vacuum end-to-end test	During LAT T-V
5.3.5	Operating Modes	Accommodate mission operating mode: Load Shedding function	D	Flight LAT thermal-vacuum end-to-end test	During LAT T-V
5.3.6	Instrument Mass	<3000 kg as allocated to each subsystem	T	Weigh LAT	After integration. After final test
5.3.7	CG Constraints	Z-axis CG <= 0.246 m from interface plane.	T	Measure reaction torque with LAT on its side in integration fixture	After integration, before testing starts
5.3.8	Envelope	1.8 m x 1.8 m x 3.15 m	I	Survey LAT	After integration
5.3.9	Interface Structure	SI to mount to the spacecraft via an interface structure, which is part of the spacecraft.	I	Test interface with gauge from SC contractor with Grid and check interferences with TEM boxes	Before integration, after integration
5.3.10.1	Average Power	<= 650 W per 24 hour period **(TBR)**	T and A	???Analysis of LAT. ???Measure total power consumption of Cal. Unit in test beam to determine average rate during simulated event rate comparable to orbital rate. Scale for full LAT and for rate.	During Calibration Unit beam test
5.3.10.2	Peak Power	<= 1000 W	T and A	???Analysis of LAT. ???Measure peak power consumption of Cal. Unit in test beam to determine rate during simulated event rate comparable to orbital rate and operation mode. Scale	During Calibration Unit beam test

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				for full LAT and for rate	
5.3.10.3	Peak Power	**Duration** <= 10 minutes per orbit	A	???Analysis of LAT. ???Measure peak power consumption of Cal. Unit in test beam to determine rate during simulated event rate comparable to orbital rate and operation mode. Scale for full LAT and for rate	During Calibration Unit beam test
5.3.11	Thermal Design	Dissipate all thermal loads from internal power usage, on-orbit thermal fluxes	T and A	Thermal analysis of LAT. Radiator thermal analysis. Thermal balance test of “Qual. LAT” with thermal models and flight radiators	Concurrent with flight LAT integration
5.3.11	Thermal Design	No more than 5 W conducted from the spacecraft to the instrument	A	***SC contractor thermal analysis of LAT mounting structure. Possibly do a thermal interface heat transfer test???	
5.3.12.1	Handling Vibration and Shock	Instrument handled per controlled procedures	I	Review LAT handling travelers.	
5.3.12.2	Transportation Vibration and Shock	Transportation environment shall be less severe than the launch environment and shall be monitored.	I	Log acceleration monitor data after every transport	
5.3.12.3.1	Storage/Transportation Temperature	LAT capable of being stored indefinitely in temperature of 0 to 40 ºC (TBR)	I	Log temperature monitor data after every transport or storage. Perform LPT after every transport or storage	
5.3.12.3.2	Storage/Transportation Rel. Humidity	LAT capable of being stored indefinitely in relative humidity of 20% to 55% (TBR)	I	Log humidity monitor data after every transport or storage. Perform LPT after every transport or storage	
5.3.12.3.3	Assembly & Integration Temperature	LAT capable of operation in air at temperatures of 15 to 25 ºC (TBR)	I, T	Monitor room temperature of integration clean room. Thermal cycle in air or dry nitrogen before sending out for LAT thermal-vacuum test	After LAT integration, before T-V test
5.3.12.3.4	Assembly & Integration Relative Humidity	LAT capable of operation in relative humidity of 35% to 55% (TBR)	I, T	Monitor room relative humidity of integration clean room. Monitor humidity during thermal cycle test	After LAT integration, before T-V test
5.3.12.3.5	Launch Vehicle Temperature	LAT able to withstand launch vehicle environment of 13 to 27 ºC when off.	T	Included in LAT thermal-cycle test range.	After LAT integration, before T-V test
5.3.12.3.6	Launch Vehicle Relative Humidity	LAT able to withstand launch vehicle environment of 40% to 55% relative humidity in any operation mode.	I	Included in LAT thermal-cycle test range	After LAT integration, before T-V test
5.3.12.3.7	Ground Processing Temperature Rate of Change	LAT able to withstand 5 ºC/hour max rate of change for all ground processing in any operation mode.	I	Run LAT during thermal-cycle test ramping at maximum rate of change	After LAT integration, before T-V test
5.3.12.4.1	Thrust Axis Loads, Primary Structures	LAT primary structures able to withstand static loads in thrust direction of 3.25/-0.8 g at	T and A	LAT vibe test: sine-burst test in thrust direction	After LAT T-V test

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		liftoff/transonic, 6.0 ±0.6 g at MECO			
5.3.12.4.2	Lateral Axis Loads, Primary Structures	LAT primary structures able to withstand lateral static loads of ±4.0 g at liftoff/transonic and ±0.1 g at MECO	T and A	LAT vibe test: sine-burst test in each lateral direction	After LAT T-V test
5.3.12.4.3	Combined Loads, Primary Structures	Thrust and lateral loads applied simultaneously and in all combinations	T and A	LAT vibe test: apply sine bursts in all axes simultaneously.	After LAT T-V test
5.3.12.4.4	Static Loads, Secondary Structures	Secondary structures designed for limit load of ±12.0 g applied to each axis independently	T and A	***Subsystem tests to confirm this.	Before LAT integration.
5.3.12.5.1	Instrument Random Vibration	LAT qualified for ASD vibration levels per GEVS Table D-6	T and A	LAT vibe test: random-vibration test.	After LAT T-V test
5.3.12.5.2	Component Evaluation Vibration	Subsystems verified for vibration per GEVS Table 2.4-4	T and A	***Subsystem tests to confirm this.	Before LAT integration.
5.3.12.6	Acoustic Loads	LAT qualified for acoustic loads per GEVS Table D-3	T and A	LAT acoustic test	After LAT vibration test.
5.3.12.7	Shock	LAT capable of normal operation after shock levels per GEVS Table D-8 or D-9, as applicable	A	***Tested at Observatory level	After LAT delivery
5.3.12.8	Launch Temperature	LAT must withstand 0 to 30 degC temp range during launch.	T and A	Included in LAT thermal-cycle testing	After LAT integration
5.3.12.9	Launch Pressure	LAT capable of tolerating time rate of change per Delta II Payload Planner's Guide, Section 4.2.1, Fig 4.2 when off.	A	Venting analysis of LAT	For CDR
5.3.12.10	On-Orbit Thermal	Instrument must handle thermal fluxes: The solar constant thermal flux is 1419 W/m2 in the hot case and 1286 W/m2 in the cold case. The Earth IR thermal flux is 265 W/m2 in the hot case and 208 W/m2 in the cold case. The albedo factors are 0.40 (hot) and 0.25 (cold).	T and A	Radiative thermal analysis of LAT Thermal-balance test of "Qual LAT" with simulated external heat loads.	Analysis for CDR Thermal-balance test done during flight LAT integration
5.3.12.11.1	Total Dose Radiation	Instrument must withstand 5 times the total dose estimate given in GLAST MSS Section 3.2.4.1.2.1.1	A	***Subsystem component irradiation tests	
5.3.12.11.2	LET Spectrum	Instrument must withstand LET spectrum given in GLAST MSS Section 3.2.4.1.2.1.3	A	***Subsystem component irradiation tests	
5.3.12.11.3	Single Event Effects	Parts shall be selected for immunity to single event effects, using LET of	T and A	*** Subsystem component irradiation tests	

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		8 $MeV/mg/cm^2$ as guideline.			
5.3.12.12	On-Orbit Meteoroid and Debris Flux	Instrument must withstand meteoroid and debris flux estimates given in GLAST MSS Section 3.2.4.1.2.2 for impact probabilities of 0.001 and above (TBR)	A	Probabilistic risk analysis of LAT by System Engineering. Impact damage analysis of micro-meteoroid shield	Before CDR. Before CDR.